



National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California



Mars Exploration Directorate

Mars Exploration Program Analysis Group “MEPAG”

Dr. Fuk Li

June 16, 2011



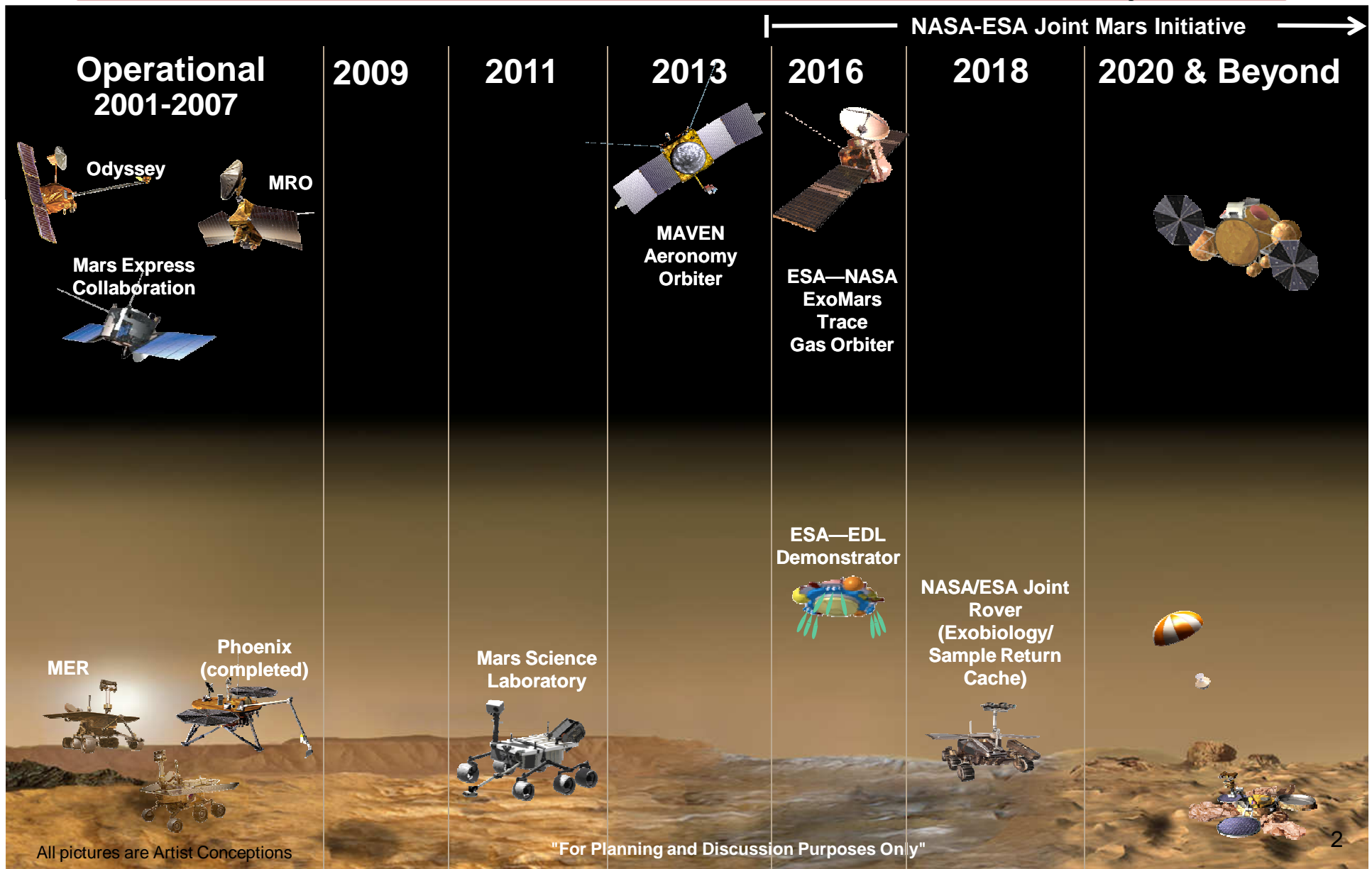
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MEP Overview



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MEP Operation Missions



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- ODY
 - 4th extended mission on-going
 - Spacecraft is healthy
 - THEMIS continues to obtain thermal infrared imagery superior to previous phases of mission; Neutron Spectrometer and HEND still accumulating data on subsurface
 - Primary relay function for MER
 - Preparing for support to MSL: EDL coverage and data relay
- MER
 - Spirit recovery effort concluded in late May
 - Opportunity is roving towards the Endeavour crater
 - ~3 km away
 - Had roved ~30 km
- MRO
 - 1st extended mission/preparing for MSL relay phase
 - Spacecraft is healthy
 - Science payload continues to generate high resolution imagery, hyperspectral information, global and atmospheric monitoring and shallow subsurface radar imaging
 - Provides critical data for landing site characterization for MSL and other landing missions



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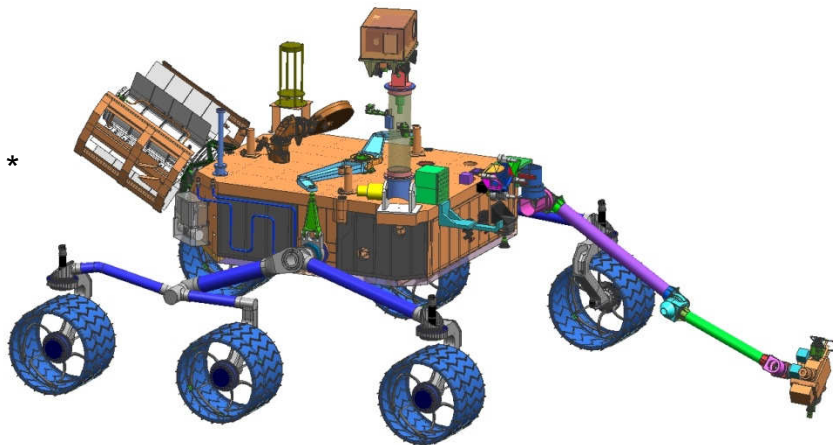
MSL Project Overview



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Science

- Focus on Past & Present Habitability of Mars
- Highly Capable Analytical Laboratory
- Next Generation Remote Sensing & Contact Investigations
- Suite of Environmental Monitoring Instruments



* Artist Conception

Technical Capabilities

- Category 1
- Risk Class B
- One Mars Year surface operational lifetime (669 sols/687 days)
- Discovery Responsive over wide range of latitudes and altitudes
- Precision Landing via Guided Entry
- Skycrane Propulsive Landing
- Long Distance Traverse Capability (20 km)
- Flexible & Robust Sample Acquisition & Processing

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MSL in ATLO Process



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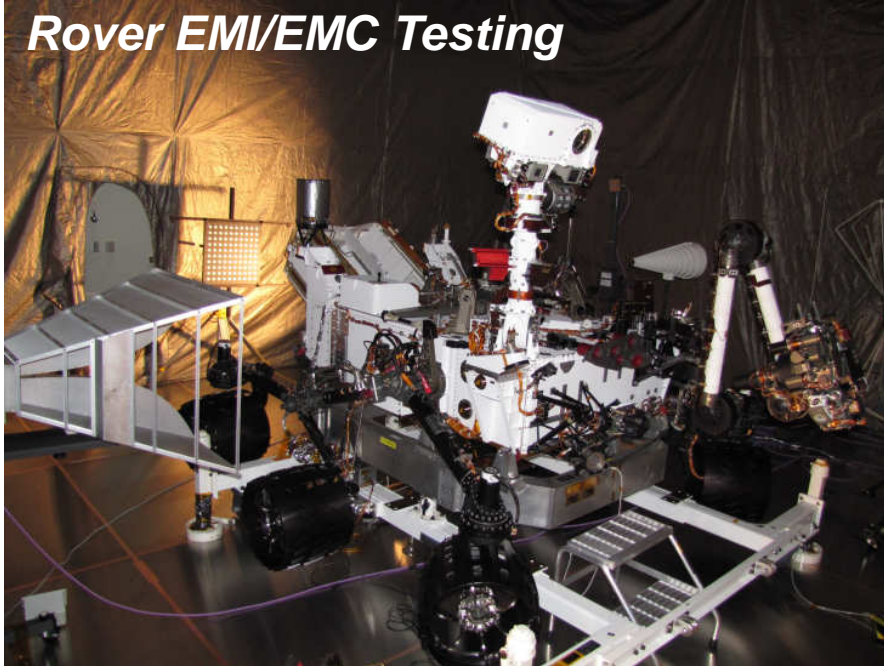
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MSL Environmental Testing



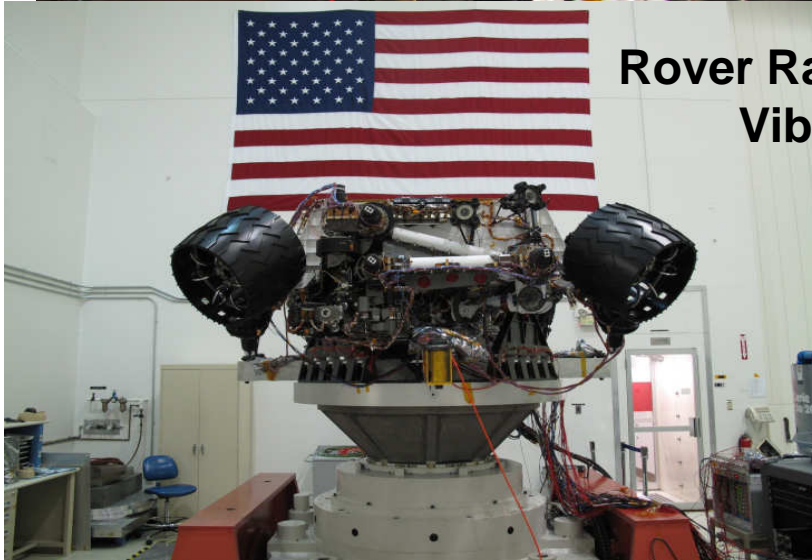
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Rover EMI/EMC Testing

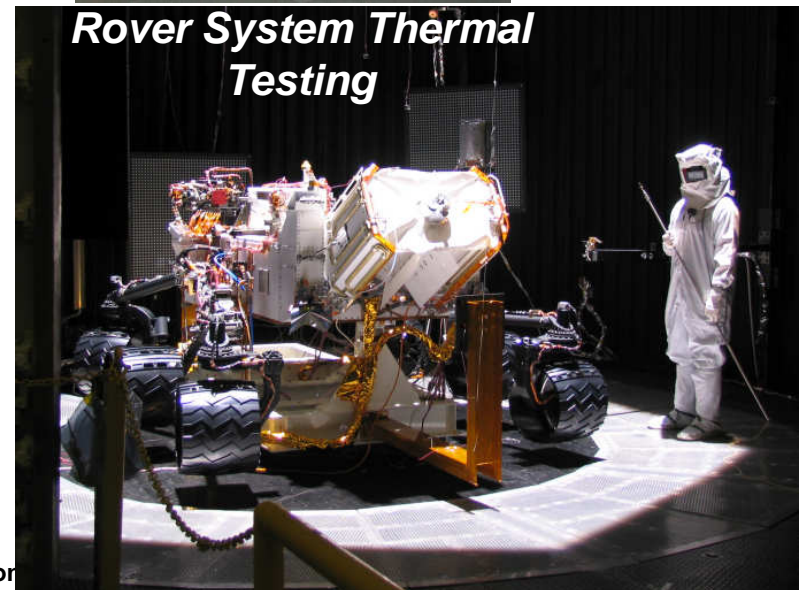


**Cruise
Stage STV**

**Rover Random
Vibe**



**Rover System Thermal
Testing**



and Discussion



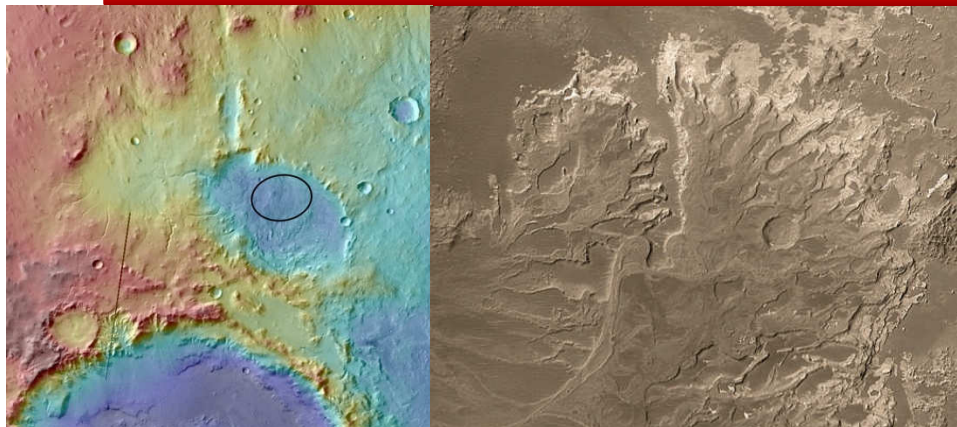
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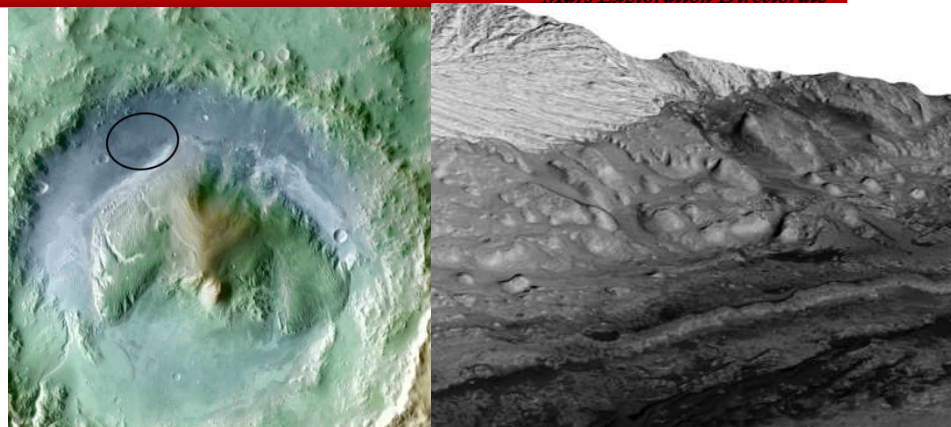
MSL Candidate Landing Sites



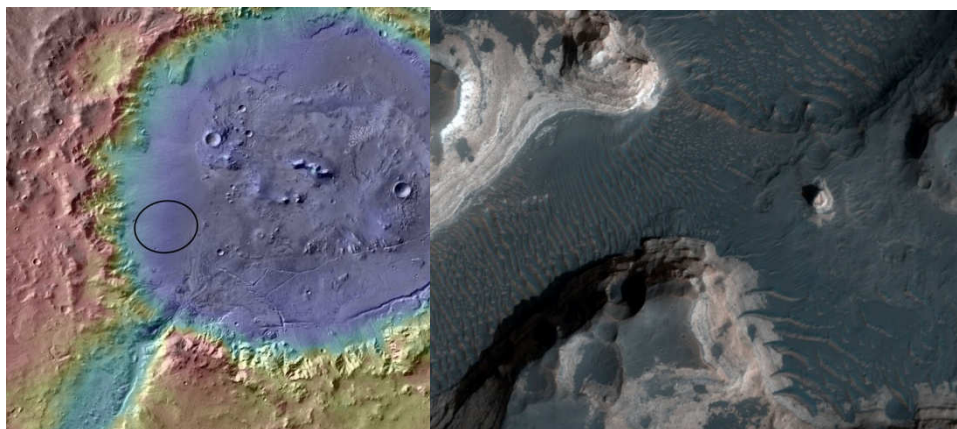
Mars Exploration Directorate



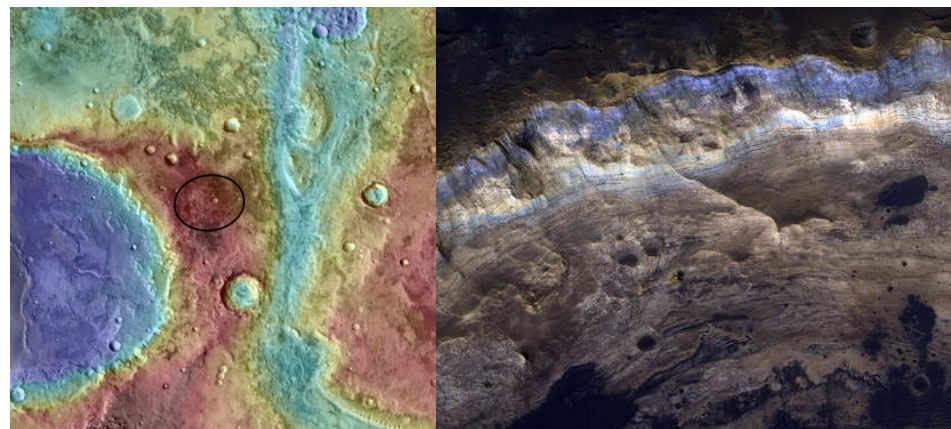
Eberswalde Crater (24°S , 327°E , -1.5 km) contains a clay-bearing delta formed when an ancient river deposited sediment, possibly into a lake.



Gale Crater (4.5°S , 137°E , -4.5 km) contains a 5-km sequence of layers that vary from clay-rich materials near the bottom to sulfates at higher elevation.



Holden Crater (26°S , 325°E , -1.9 km) has alluvial fans, flood deposits, possible lake beds, and clay-rich sediment.



Mawrth Vallis (24°N , 341°E , -2.2 km) exposes layers within Mars' surface with differing mineralogy, including at least two kinds of clays.

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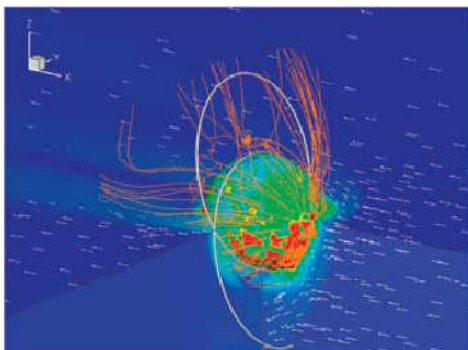
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MAVEN Project Overview



Mars Exploration Directorate

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Mission Objectives

- Determine the role that loss of volatiles from the Mars atmosphere to space has played through time, exploring the histories of Mars' atmosphere and climate, liquid water, and planetary habitability
- Determine the current state of the upper atmosphere, ionosphere, and interactions with solar wind
- Determine the current rates of escape of neutrals and ions to space and the processes controlling them
- Determine the ratios of stable isotopes that will tell Mars' history of loss through time

Organizations

- LASP – PI and science team; E/PO; science operations; IUVS and LPW instruments
- GSFC – project management; mission systems engineering; safety and mission assurance; project scientist; NGIMS and MAG instruments
- JPL – Navigation; DSN; Mars Program Office
- SSL – Deputy PI; Particles and Fields Package management; STATIC, SEP, SWIA, and SWEA instruments; LPW probes and booms (IRAP provides the sensor for SWEA)
- LM – spacecraft; assembly, test and launch operations; mission operations

Launch

- On an Atlas V from KSC between 11/18/13 and 12/7/13
- Mars Orbit Insertion on 9/22/14 (for 11/18/13 launch)

Website

<http://www.nasa.gov/maven>
<http://lasp.colorado.edu/maven/>

Mission Approach

- Obtain detailed measurements of the upper atmosphere, ionosphere, planetary corona, solar wind, solar EUV and SEPs over a 1-year period, to define the interactions between the Sun and Mars
- Operate 8 instruments for new science results:
 - Particles and Fields Package (6 instruments):
 - SWEA - Solar Wind Electron Analyzer
 - SWIA - Solar Wind Ion Analyzer
 - STATIC - Suprathermal and Thermal Ion Composition
 - SEP - Solar Energetic Particle
 - LPW - Langmuir Probe and Waves
 - MAG - Magnetometer
 - IUVS - Imaging Ultraviolet Spectrometer
 - NGIMS - Neutral Gas and Ion Mass Spectrometer
- Fly 75°-inclination, 4.5-hour-period, 150-km-periapsis-altitude science orbit
- Perform five 5-day “deep dip” campaigns to altitudes near 125 km during the 1-year mission



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Mission Architecture

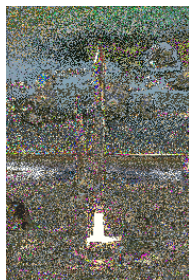
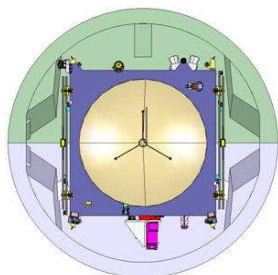
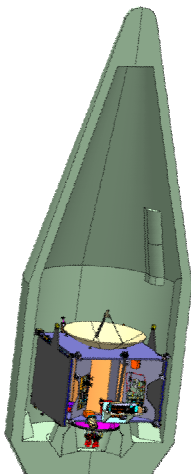


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* 20-Day Launch Period

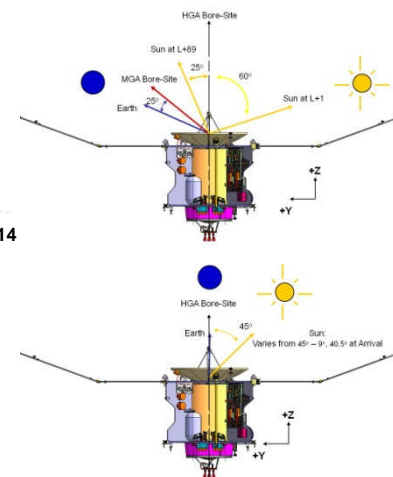
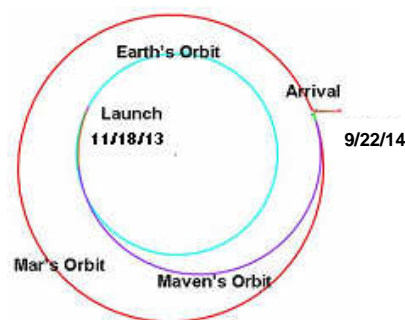
18 Nov 2013 (Open)
7 Dec 2013 (Close)

LV: Atlas V 401



* Ten Month Ballistic Cruise to Mars

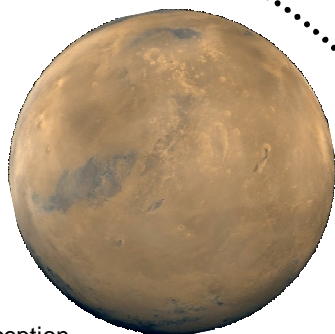
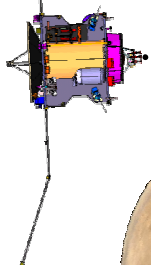
Type-II Trajectory



Early Cruise

Late Cruise

* Northern Approach
~1233 m/s ΔV

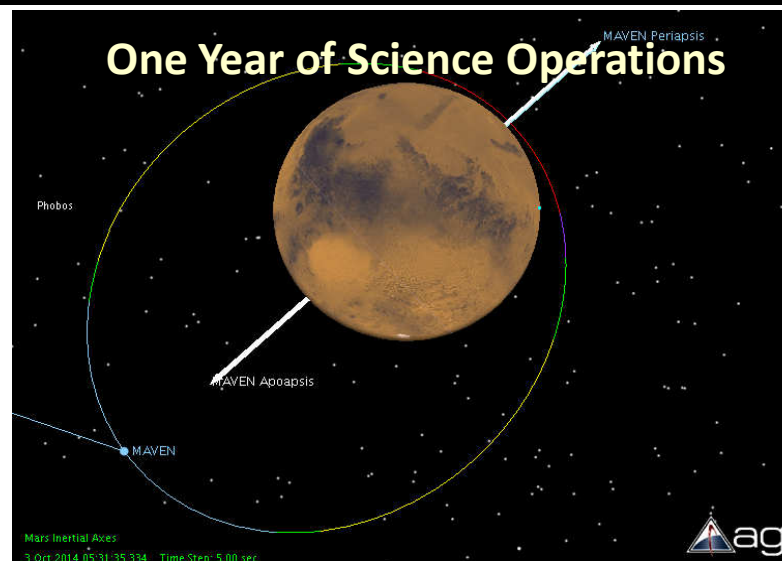


Orbit Insertion:
22 Sept 2014 (Open)
26 Sept 2014 (Close)

Capture Orbit:
35 hour period
550 km P2
75° inclination

* Artist Conception

* One Year of Science Operations



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Current Status and Plans

- We are executing on the plan laid out in the proposal three years ago
 - Spacecraft, instrument and ground systems hardware are being built across the partner institutions; contracts are negotiated; launch service has been authorized
 - MAVEN is now in the midst of a full press for a successful CDR Season
- The MAVEN Project has been and continues to receive full funding when it's been needed. Reserves are at acceptable levels in every year between now and launch
- Schedule is a continuing focus given the 20-day planetary launch window. MAVEN has sufficient schedule margins but we are always looking at opportunities for improvement
- **MAVEN is on track technically, on schedule and on budget**



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